Patent claims

1. A method for the separation of macromolecules from their mixtures of high and low molecular substances characterized in that
   - at least one non-porous polymer film is utilized as a separation medium by exploiting the permeation of the film
   - films are considered non-porous if their pores do not completely impenetrate the film from side to side
   - during separation, the temperature of the at least one non-porous polymer film is equal to or greater than the glass transition temperature of the amorphous regions of said at least one polymer film used for the separation.
2. A method according to claim 1, characterized in that, in the case that the temperature of the at least one non-porous polymer film utilized as a separation medium is lower than the glass transition temperature of the amorphous regions of this at least one non-porous polymer film, this glass transition temperature will be lowered before the start of separation by swelling with a solvent to a level below or equal to the temperature of the at least one non-porous polymer film utilized as a separation medium.
3. A method according to claim 2, characterized in that the solvent contains at least one liquid from the group of protic, aprotic, aqueous, aliphatic, aromatic, heteroaliphatic, heteroaromatic, alicyclic, and/or heteroalicyclic liquids.
4. A method according to one of the claims 1-3 characterized in that the at least one polymer film utilized for the separation consists of one or more of

the following polymers and/or contains one or more of the following polymers selected from the group of polymers such as poly-(p-xylylene), polyvinylidene halides, polyester, polyether, polyolefins, polycarbonates, polyurethanes, natural polymers, polycarboxylic acids, polysulfonic acids, sulphated polysaccharides, polylactides, polyglycosides, polyamides, polyvinylalcohols, poly-α-methylstyrenes, polymethacrylates, polyacrylnitriles, poly-(p-xylyles), polyacrylamides, polyimides, polyphenylenes, polysilanes, polysiloxanes, polybenzimidazoles, polybenzthiazoles, polyoxazolines, polysulfinides, polyesteramides, polyarylenvinylenes, polyetherketones, polyurethanes, polysulfones, ormocerenes, polyacrylates, silicones, fully aromatic copolyesters, poly-N-vinylpyrrolidones, polyhydroxyethylmethacrylates, polymethylmethacrylates, polyethylenterephthalates, polymethacrylnitriles, polyvinylacetates, neoprene, Buna N, polybutadienes, polytetrafluorethylenes, modified or unmodified celluloses, α-olefins, vinylsulfonic acids, maleic acids, alginates or collagens.

5. A method according to one of the claims 1-4 characterized in that the monomers that form the basis of the at least one polymer film can each support one or more functional groups, whereby each case is a singular type or different types of the substituents H, linear or branched alkyl, alkenyl, alkinyl, cycloalkyl, cycloalkenyl, cycloalkinyl, phenyl, phenylalkyl, phenylalkenyl, phenylalkinyl, phenylcycloalkyl, phenylcycloalkenyl, phenylcycloalkinyl, cycloalkyl-alkyl, cycloalkyl-alkenyl, cycloalkyl-alkinyl, heterocyclic compounds, heterocyclo-alkyl, heterocyclo-alkenyl, heterocyclo-alkinyl, linear or branched

alkylsulphonate, alkenylsulphonate, alkinylsulphonate, linear or branched alkylbenzenesulphonate, alkenylbenzenesulphonate, alkinylbenzenesulphonate, aminosulphonyl-alkyl, aminosulphonyl-alkenyl, aminosulphonyl-alkinyl, aminosulphonyl-cycloalkyl, aminosulphonyl-cycloalkenyl, aminosulphonyl-cycloalkinyl, linear or branched alkyl-sulphonamide, alkenyl-sulphonamide, alkinyl-sulphonamide, cycloalkyl-sulphonamide, cycloalkenyl-sulphonamide, cycloalkinyl-sulphonamide, phenyl-sulphonamide, heterocyclo-sulphonic acid, heterocyclo-sulphonamide, heterocyclo-alkyl-sulphonic acid, heterocyclo-alkyl-sulphonamide, heterocyclo-alkenyl-sulphonic acid, amide- or esterlike bound linear and/or branched-chain aliphatic sulphonic, carbolyxic, and/or phosphonic acid, styrene sulphonic acid, anetol sulphonic acid, styrene phosphonic acid, heterocyclo-alkenyl-sulphonamide, heterocyclo-alkinyl-sulphonic acid, heterocyclo-alkinyl-sulphonamide, aryl-sulphonic acid, aryl-sulphonamide, aryl-alkyl-sulphonic acid, aryl-alkyl-sulphonamide, aryl-alkenyl-sulphonic acid, aryl-alkenyl-sulphonamide, aryl-alkinyl-sulphonic acid, aryl-alkinyl-sulphonamide, alkyl-, alkenyl, alkinyl-, aryl-, heteroalkyl-, heteroaryl-carboxylic acids, esters thereof, carboxylic acid amides thereof, amino acids, orthologous phosphonic acid derivatives of all sulphonic acids listed, hydroxy-alkyl-, hydroxy-alkenyl-, hydroxy-alkinyl-, hydroxy-cycloalkyl-, hydroxy-alkyl-cycloalkyl-, hydroxy-cycloalkyl-alkyl-, hydroxy-phenyl-, hydroxy-alkyl-phenyl-, hydroxy-phenyl-alkyl-groups as well as the orthologous amino- and thio- compounds, polyethoxy-alkyl, polyethoxy-alkenyl, polyethoxy-alkinyl, polyethoxy-cycloalkyl, polyethoxy-cycloalkenyl, polyethoxy-cycloalkinyl, polyethoxy-aryl, polyethoxy-alkyl-aryl, polyethoxy-heterocycloalkyl,

polyethoxy-heterocycloaryl, alkanal, alkenal, alkinal, cycloalkenal, benzene carbaldehyde, heteroaryl-carbaldehyde, benzyl-alkyl-carbaldehyde, heteroaryl-carbaldehyde, aliphatic heteroalkyl-alkenal, hetero-alkenyl-alkenal, hetero-alkinyl-alkenal, alkanon, alkenon, alkinon, cycloalkyl-alkanon, dicycloalkanon, arylalkanon, heteroaryl-alkanon, imines, halogens und halogenated derivatives of all groups listed, nitriles, isonitriles, sulphonic acid esters, phosphonic acid esters, nitro compounds, hydroxylamines, allyl compounds, adenosin-3',5'-monophosphate, adenosin-3',5'-diphosphate, adenosin-3',5'-triphosphate, guanosin-3',5'-monophosphate, guanosin-3',5'-diphophate, guanosin-3',5'-triphosphate, dextransulphate cellulose, cation exchanging groups, anion exchanging groups, wherein alkyl preferably stands for a group with 1-20 carbon atoms, alkenyl and alkinyl preferably stand for mono- or polyunsaturated groups with 2-20 carbon atoms, cycloalkyl, -alkenyl and -alkinyl preferably stand for a group with 3-20 carbon atoms, the heterocyclic groups preferably stand for an R group with 1-20 carbon atoms, wherein up to 5 carbon atoms can be replaced by hetero atoms selected from the group nitrogen, oxygen, sulfur, phosphorus, aryl preferably stands for an aromatic R group with 5-20 carbon atoms, heteroaryl stands for a corresponding aromatic R group, wherein up to 5 carbon atoms are replaced by hetero atoms, which can be selected from the group nitrogen, oxygen, sulfur, phosphorus.

6. A method according to one of the claims 1-5 characterized in that macromolecular components with a molecular weight between 50 g/mol and 500,000 g/mol, preferably between 1,000 g/mol and 50,000 g/mol, pass the permeation layer.

7. A method according to one of the claims 1-6 characterized in that for separation, at least one polymer film with a thickness equal to or smaller than 100 micrometers, preferably a thickness equal to or smaller than 50 micrometers, with special preference for a thickness equal to or smaller than 1 micrometer, with very special preference for a thickness equal to or smaller than 100 nanometers.

8. A method according to one of the claims 1-7 characterized in that at least one semi-crystalline polymer film is utilized for the separation.

9. A method according to one of the claims 1-8 characterized in that chemically cross-linked polymer films are utilized for the separation.

10. A method according to one of the claims 1-9 characterized in that for the separation, at least one polymer film is utilized which consists of block polymers, graft copolymers, or blends.

11. A method according to one of the claims 1-10 characterized in that multi-layer films are utilized for the separation, wherein such polymer films are considered multi layer films which consist of at least two layers of differing or identical polymers.

12. A method according to claim 11 characterized in that a multi layer film is utilized in which the first polymer film is directly coated with the other polymer films.

13. A method according to one of the claims 1-12 characterized in that for the separation, at least one polymer film is utilized which consists of several polymers with different chemical structures.

14. A method according to one of the claims 1-13 characterized in that for the separation, at least one polymer film is utilized which features a chemical gradient.

15. A method according to one of the claims 1-14 characterized in that for the separation at least one polymer film consisting of reactive polymers is utilized.

16. A method according to one of the claims 1-15 characterized in that for the separation at least one polymer film is utilized which features a rough and/or porous surface topology.

17. A method according to one of the claims 1-16 characterized in that for the separation at least one polymer film containing solid flux is utilized.

18. A method according to one of the claims 1-17 characterized in that for the permeation, at least one polymer film that is coated on or between porous substrates is utilized.

19. A method according to one of the claims 1-18 characterized in that for the separation at least one polymer film is utilized which features other geometries, preferably a polymer film consisting of hollow fibers.

20. A method according to claim 19 characterized in that the diameters of the hollow fibers' wall thicknesses are equal to or smaller than 5 micrometers, preferably equal to or smaller than 500 nanometers, with special preference for those that are equal to or smaller than 50 nanometers.

21. A method according to one of the claims 1-20 characterized in that the polymer systems to be separated are presented dissolved in one single solvent or mixture of solvents.

22. A method according to one of the claims 1-21 characterized in that the solution to be separated, which contains at least one macromolecule, has a

portion of this one or more macromolecule/s of between 0.1 and 50 percent of its weight.

23. A method according to one of the claims 1-22 characterized in that the separation is carried out in combination with light dispersion and/or viscosimetry and/or UV-Vis spectroscopy and/or gel permeation chromatography and/or solvent precipitation.

24. A method according to one of the claims 1-23 characterized in that the pressure is adjusted in a controlled manner.

25. A method according to one of the claims 1-24 characterized in that tandem configurations are utilized, whereby the term "tandem configurations" refers to such systems in which several permeation configurations, i.e. configurations with at least one non-porous polymer film each, are aligned parallel and/or one after the other, wherein between these permeation configurations there is a liquid medium.

26. Utilization of separation media containing at least one non-porous polymer film for the separation of one or more macromolecules from their mixtures with high or low molecular substances in respect to their molecular weights, their chemical structure, and/or their degree of branching.

27. Utilization of separation media containing at least one non-porous polymer film according to claim 26, characterized in that macromolecules with a molecular weight between 50 g/mol and 500,000 g/mol are separated.

28. Utilization of separation media containing at least one non-porous polymer film according to claim 26, characterized in that macromolecules with a molecular weight of more than 500,000 g/mol are purified.

29. Utilization of separation media containing at least one non-porous polymer film according to claims 26 to 28, characterized in that one or more macromolecules from byproducts in the synthesis of macromolecules and/or from catalysts and/or from colloidal additives are separated.